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PATENT & TRADEMARK OFFICE

Docket 87428AJA
Customer No. 01333

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re Application of

Joseph F. Bringley

DERIVATIZED NANOPARTICLE COMPRISING METAL-ION SEQUESTRANT

Serial No. 10/822,940

Filed April 13, 2004

Group Art Unit: 1773

Examiner: Hoa T. Le

I hereby certify that this correspondence is being deposited today with the United States Postal Service as first class mail in an envelope addressed to Commissioner For Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

Frieda Grinnell

Frieda Grinnell

Date July 10, 2006

Mail Stop APPEAL BRIEF-PATENTS
Commissioner for Patents
P.O. Box 1450
Alexandria, VA. 22313-1450

Sir:

APPEAL BRIEF TRANSMITTAL

Enclosed herewith is Appellants' Appeal Brief for the above-identified application.

The Commissioner is hereby authorized to charge the Appeal Brief filing fee to Eastman Kodak Company Deposit Account 05-0225. A duplicate copy of this letter is enclosed.

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Respectfully submitted,

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Enclosures
If the Examiner is unable to reach the Applicant(s) Attorney at the telephone number provided, the Examiner is requested to communicate with Eastman Kodak Company Patent Operations at (585) 477-4656.

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Sir:

APPEAL BRIEF PURSUANT TO 37 C.F.R. 41.37 and 35 U.S.C. 134

Appellants hereby appeal to the Board of Patent Appeals and Interferences from the Examiner's Final Rejection of claims 1-44, which was contained in the Office Action mailed December 7, 2005.

A timely Notice of Appeal was filed March 10, 2006 (with certificate of First Class mailing dated March 7, 2006).

A request for a two-month extension of time for filing of the Appeal Brief is submitted herewith.

Respectfully submitted,

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APPELLANT'S BRIEF ON APPEAL

Real Party In Interest

The Eastman Kodak Company is the assignee and real party in interest.

Related Appeals And Interferences

No appeals or interferences are known which will directly affect or be directly affected by or have bearing on the Board's decision in the pending appeal.

Status Of The Claims

Claims 1-44 are pending under the appeal.

Claims 45-62 are withdrawn from consideration.

Appendix I provides a clean, double-spaced copy of the claims on appeal.

Status Of Amendments

There have been no amendments to the application subsequent to the Final Office Action mailed December 7, 2005.

Summary of Claimed Subject Matter

Independent claim 1 is directed towards a composition of matter comprising derivatized nanoparticles comprising inorganic nanoparticles (page 6, lines 3-14) having an attached metal-ion sequestrant (page 9, line 28 – page 11, line 8), wherein said inorganic nanoparticles have an average particle size of less than 200 nm and the derivatized nanoparticles have a stability constant greater than 10^{10} with iron (III) (page 5, lines 12-14).

Independent claim 22 is directed towards an article (page 12, line 28 – page 13, line 13) comprising immobilized derivatized nanoparticles, said derivatized nanoparticles comprising inorganic nanoparticles (page 6, lines 3-14) having an attached metal-ion sequestrant (page 9, line 28 – page 11, line 8), wherein said inorganic nanoparticles have an average particle size of less than 200 nm and the derivatized nanoparticles have a stability constant greater than 10^{10} with iron (III) (page 5, lines 12-14; page 12, lines 31-32).

Grounds of Rejection to be Reviewed on Appeal

1. Claims1-3, 6-10, and 15-21 are rejected under 35 U.S.C. 102(b) as being anticipated by Ranney (US 6,106,866).

2. Claims 1-44 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ranney (US 6,106,866) in view of DeVoe et al. (US 4,530,963).

Arguments

The 35 U.S.C. 102(b) Rejection Over Ranney

This rejection is respectively urged as being in clear error, as the Examiner has not identified any specific disclosure in Ranney with respect to derivatized nanoparticles comprising <u>inorganic</u> nanoparticles having an attached metal-ion sequestrant as required by independent claim 1. Rather, the only specific carriers for the metal chelators described in Ranney appear to be <u>organic materials</u>, mainly organic polymers, more specifically biological polymers. Accordingly, Ranney clearly does not anticipate the present independent claim 1, and the Board is respectively requested to reverse such anticipation rejection.

The 35 U.S.C. 103(a) Rejection over Ranney in view of DeVoe et al.

In the final office action of December 7, 2005 the Examiner referred to the office action of July 6, 2005, wherein the Examiner stated the rejection of the claims 1-44 over Ranney in view of DeVoe et al. as follows:

> "The Ranney patent teaches an in vivo agent comprising a nanoparticle of less than 250 nm as the base (drug carrier) and a metal ion sequestrant (metal chelator) on the surface of the nanoparticle as discussed above. The Ranney does not specify the materials for the nanoparticle and gives limited teaching regarding the materials suitable as the chelating agent. Similar to the Ranney patent, the DeVoe also teaches a composition comprising a carrier and a chelator on the surface of the carrier. See DeVoe, col. 2, lines 25-35. However, the DeVoe patent gives more details as to the materials for the carrier and the chelators. The DeVoe further teaches the carrier being an inorganic material (DeVoe, col. 12, lines 64-65); and specific materials as chelators that function well over a wide assortment of heavy metal ions (DeVoe, col. 2, lines

> 33-35 and col. 5, lines 17-21). In other words, the Ranney utilizes the new nanotechnology by employing a nanoparticle as the carrier, and the DeVoe gives specific details in selecting the components that would serve the purposes sought by Ranney (i.e. metal ion sequestration). Therefore, one having ordinary skill in the art would have found it obvious to combine the teachings of Ranney and DeVoe in order to obtain a composition comprising a nanostructured carrier and chelators that provide high stability for heavy metals, in particular iron(III). The outcome of this combination would be the best possible results in metal ion sequestration.

It is respectively urged that in the instant application the Examiner has not established a *prima facie* case that the instant inventions of independent claims 1 and 22 are obvious over Ranney in view of DeVoe et al.

The invention of independent claim 1 provides a composition of matter comprising derivatized nanoparticles comprising inorganic nanoparticles having an attached metal-ion sequestrant, wherein said inorganic nanoparticles have an average particle size of less than 200 nm. The derivatized nanoparticles of the invention are able to target and remove specific metal-ions from a solution, while leaving intact the concentrations of beneficial metal-ions. They can be utilized in numerous items and articles without significantly changing their color or appearance and they are easy to apply. The nanoparticles can be utilized to remove metal ions, which are themselves contaminants, or they can be used to remove metal ions which are nutrients for biological contaminants. The invention of independent claim 22 provides an article comprising immobilized derivatized nanoparticles, said derivatized nanoparticles similarly as in claim 1 comprising inorganic nanoparticles having an attached metal-ion sequestrant wherein said inorganic nanoparticles have an average particle size of less than 200 nm and the derivatized nanoparticles have a stability constant greater than 10^{10} with iron (III).

In contrast, the compositions of Ranney are directed towards drug delivery systems and medical imaging enhancement. The system in which the compounds of Ranney are utilized is the human body. The carriers in Ranney must then be <u>biologically compatible and preferably hydrophilic</u> (water soluble and water

dispersible, col. 2, lines 55-62), and are specifically described as purified dermatan sulfate (col. 15, 49-53), or other organic materials (col. 19, lines 45-54; col. 34, lines 43-55). The metal chelators/carriers described in Ranney are not intended to remove metal ions from the system, rather they appear to be intended for MRI imaging. In fact, the metal chelators in Ranney are already bound to the metal when they are injected or ingested into the body, as the metal is the aspect of the compound that provides the image. While DeVoe et al describes use of inorganic carriers as well as organic carriers for metal chelating compositions, such compositions of DeVoe et al are insoluble and used to remove metal from aqueous solutions such as water. Accordingly, the compositions and technology described in Ranney and DeVoe are very different from each other. As the compounds of DeVoe et al. are utilized for an entirely different purpose than those of Ranney, and would not be suitable for the use in the system of Ranney, it would accordingly not be obvious to the artisan to substitute the insoluble inorganic carriers of DeVoe et al for the specified hydrophilic organic carriers of Ranney. To the contrary, to do so would defeat the purpose of Ranney of providing the specified carriers thereof to provide biocompatibility and water-solubility/dispersibility as part of a drug delivery system.

Additionally, as the technology of Ranney describes the use and formation of organic materials to act as hydrophilic carriers, the teachings of Ranney could not be utilized with the inorganic carriers discussed in DeVoe to form inorganic nanoparticles. Further, while Ranney does discuss small organic particles, that feature is mainly directed toward making the materials more biocompatible. The organic materials of Ranney need to be small in size to be nonembolizing, for example, to avoid obstructing a blood vessel when used in a live human being. The small size also leads to desirable rapid partial or total endothelial envelopment of the particle. These aspects are not useful when applied to DeVoe. Therefore, the combination of Ranney and DeVoe would not direct one skilled in the art to arrive at the current invention, as formation of inorganic nanoparticles is not disclosed or suggested in either reference, much less their formation and use

with a metal ion sequestrant. Therefore, a prima facie case of obviousness with respect to the current claimed invention has clearly not been established based on the combination of Ranney and DeVoe et al.

Additionally with respect to Claims 3, 17-18, 26, 40, and 41, these claims are believed to be further separately patentable over the applied prior art with respect to independent claim 1 because they are directed towards compositions or articles comprising especially preferred, very small, derivatized inorganic nanoparticles; in particular, particles having a size of less than 20 nm or a surface area of greater than 300 m^2/g. DeVoe does not disclose or suggest use of any nanoparticles having such size. Ranney may suggest organic nanoparticles having a size of 25 nm or less, but does not disclose or suggest use of inorganic nanoparticles having a preferred size of 20 nm or less.

Additionally with respect to Claims 4, 5, 27, and 28, these claims are believed to be further separately patentable over the applied prior art with respect to independent claim 1 because they are directed towards compositions or articles comprising especially preferred materials that comprise the inorganic nanoparticles. Neither DeVoe et al. nor Ranney disclose or suggest use of inorganic nanoparticles having these specific compositions and having an average particle size of less than 200 nm.

Additionally with respect to Claims 22-44, these claims are believed to be further separately patentable over the applied prior art with respect to independent claim 1 because they are directed toward an article comprising immobilized derivatized inorganic nanoparticles, wherein the nanoparticles have an average particle size of less than 200 nm. Neither DeVoe nor Ranney disclose or suggest an article comprising such immobilized particles.

Summary

It is respectively urged that the rejection under 35 U.S.C. 102(b) over Ranney is in clear error. Ranney does not disclose inorganic nanoparticles and thus there is clearly no anticipation of the claimed invention.

It is also respectively urged that the rejection under 35 U.S.C. 103(a) over Ranney combined with DeVoe et al fails to establish a *prima facie* case of obviousness, and accordingly is in error. DeVoe and Ranney are nonanalogous art, and furthermore, there is no motivation to combine the two, as to do so would defeat the purpose of Ranney of employing the specified biocompatible, hydrophilic carriers.

In view of the foregoing, it is believed none of the references, taken singly or in combination, disclose or suggest the claimed invention, and it is therefore respectively requested that the Board of Patent Appeals and Interferences reverse the rejection of Claims 1-44 by the Examiner. Further, withdrawn claims 45-62 are directed towards a method of using a composition having all of the limitations of independent claim 1, and the Examiner is respectfully requested to rejoin and also allow such method of use claims upon allowance of claims 1-44.

This application is accordingly believed to be in condition for allowance, the notice of which is respectfully requested.

Respectfully submitted,

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Enclosures

If the Examiner is unable to reach the Applicant(s) Attorney at the telephone number provided, the Examiner is requested to communicate with Eastman Kodak Company Patent Operations at (585) 477-4656.

Appendix I - Claims on Appeal

1. A composition of matter comprising derivatized nanoparticles comprising inorganic nanoparticles having an attached metal-ion sequestrant, wherein said inorganic nanoparticles have an average particle size of less than 200 nm and the derivatized nanoparticles have a stability constant greater than 10^{10} with iron (III).

2. The composition of matter of claim 1 wherein said inorganic nanoparticles have an average particle size of less than 100 nm.

3. The composition of matter of claim 1 wherein said inorganic nanoparticles have an average particle size of less than 20 nm.

4. The composition of matter of claim 1 wherein said inorganic nanoparticles comprise silica oxides, alumina oxides, boehmites, titanium oxides, zinc oxides, tin oxides, zirconium oxides, yttrium oxides, hafnium oxides, clays, or alumina silicates.

5. The composition of matter of claim 3 wherein said inorganic nanoparticles comprise silicon dioxide, alumina oxide, clays or boehmite.

6. The composition of matter of claim 1 wherein said metal-ion sequestrant has a high stability constant for copper, zinc, aluminum or heavy metals.

7. The composition of matter of claim 1 wherein said metal-ion sequestrant has a stability constant for iron greater than 10^{20}.

8. The composition of matter of claim 1 wherein said metal-ion sequestrant has a stability constant for iron greater than 10^{30}.

9. The composition of matter of claim 1 wherein said metal-ion sequestrant comprises an alpha amino carboxylate functional group.

10. The composition of matter of claim 1 wherein said metal-ion sequestrant comprises a hydroxamate or a catechol functional group.

11. The composition of matter of claim 1 wherein the metal-ion sequestrant is attached to the nanoparticle, by reacting the nanoparticle with a metal alkoxide intermediate of the sequestrant having the general formula:

$M(OR)_{4-x}\,R'_x$;

wherein M is silicon, titanium, aluminum, tin, or germanium;

x is an integer from 1 to 3;

R is an organic group; and

R' is an organic group containing an alpha amino carboxylate, a hydroxamate, or a catechol functional group.

12. The composition of claim 11 wherein R' is a hydroxamate, or a catechol functional group.

13. The composition of matter of claim 1 wherein said metal-ion sequestrant is attached to the nanoparticle by reacting the nanoparticle with a silicon alkoxide intermediate of the sequestrant having the general formula:

$Si(OR)_{4-x} R'_x$;

wherein x is an integer from 1 to 3;

R is an alkyl group; and

R' is an organic group containing an alpha amino carboxylate, a hydroxamate, or a catechol functional group.

14. The composition of claim 13 wherein R' is a hydroxamate, or a catechol functional group.

15. The composition of matter of claim 1 wherein said nanoparticles have a specific surface area of greater than 100 m^2/g.

16. The composition of matter of claim 1 wherein said nanoparticles have a specific surface area of greater than 200 m^2/g.

17. The composition of matter of claim 1 wherein said nanoparticles have a specific surface area of greater than 300 m^2/g.

18. The composition of matter of claim 3 wherein said nanoparticles have a specific surface area of greater than 300 m^2/g.

19. The composition of matter of claim 1 wherein substantially all the metal-ion sequestrant is covalently bound to the nanoparticles.

20. The composition of matter of claim 1 wherein greater than 95% by weight of the nanoparticles have a particle size of less than 100 nm

21. The composition of matter of claim 1 wherein greater than 95% by weight of the nanoparticles have a particle size of less than 50 nm.

22. An article comprising immobilized derivatized nanoparticles, said derivatized nanoparticles comprising inorganic nanoparticles having an

attached metal-ion sequestrant, wherein said inorganic nanoparticles have an average particle size of less than 200 nm and the derivatized nanoparticles have a stability constant greater than 10^{10} with iron (III).

23. The article of claim 22 wherein the derivatized nanoparticles are contained in a layer further comprising a binder, said layer being located on the surface of the article.

24. The article of claim 22 wherein the derivatized nanoparticles are incorporated into the materials forming the article.

25. The article of claim 22 wherein said inorganic nanoparticles have an average particle size of less than 100 nm.

26. The article of claim 22 wherein said inorganic nanoparticles have an average particle size of less than 20 nm.

27. The article of claim 22 wherein said inorganic nanoparticles comprise silica oxides, alumina oxides, boehmites, titanium oxides, zinc oxides, tin oxides, zirconium oxides, yttrium oxides, hafnium oxides, clays, or alumina silicates.

28. The article of claim 22 wherein said inorganic nanoparticles comprise silicon dioxide, alumina oxide, clays or boehmite.

29. The article of claim 22 wherein said metal-ion sequestrant has a high stability constant for copper, zinc, aluminum or heavy metals.

30. The article of claim 22 wherein said metal-ion sequestrant has a stability constant for iron greater than 10^{20}.

31. The article of claim 22 wherein said metal-ion sequestrant has a stability constant for iron greater than 10^{30}.

32. The article of claim 22 wherein said metal-ion sequestrant comprises an alpha amino carboxylate functional group.

33. The article of claim 22 wherein said metal-ion sequestrant comprises a hydroxamate or a catechol functional group.

34. The article of claim 22 wherein the metal-ion sequestrant is attached to the nanoparticle, by reacting the nanoparticle with a metal alkoxide intermediate of the sequestrant having the general formula:

$M(OR)_{4-x} R'_x$;

wherein M is silicon, titanium, aluminum, tin, or germanium;

x is an integer from 1 to 3;

R is an organic group; and

R' is an organic group containing an alpha amino carboxylate, a hydroxamate, or a catechol functional group.

35. The article of claim 34 wherein R' is a hydroxamate, or a catechol functional group.

36. The article of claim 22 wherein said metal-ion sequestrant is attached to the nanoparticle by reacting the nanoparticle with a silicon alkoxide intermediate of the sequestrant having the general formula:

$Si(OR)_{4-x} R'_{x}$;

wherein x is an integer from 1 to 3;

R is an alkyl group; and

R' is an organic group containing an alpha amino carboxylate, a hydroxamate, or a catechol functional group.

37. The article of claim 36 wherein R' is a hydroxamate, or a catechol functional group.

38. The article of claim 22 wherein said inorganic nanoparticles have a specific surface area of greater than 100 m^2/g.

39. The article of claim 22 wherein said nanoparticles have a specific surface area of greater than 200 m^2/g.

40. The article of claim 22 wherein said nanoparticles have a specific surface area of greater than 300 m^2/g.

41. The article of claim 26 wherein said nanoparticles have a specific surface area of greater than 300 m^2/g.

42. The article of claim 22 wherein substantially all the metal-ion sequestrant is covalently bound to the nanoparticles.

43. The article of claim 22 wherein greater than 95% by weight of the inorganic nanoparticles have a particle size of less than 100 nm.

44. The article of claim 22 wherein greater than 95% by weight of the inorganic nanoparticles have a particle size of less than 50 nm.

Appendix II - Evidence

None

Appendix III – Related Proceedings

None